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# The genera *Isopterygium* Mitt. (*Bryopsida*, Hypnaceae) and *Isopterygiopsis* (Hedw.) Z.Iwats. (*Bryopsida*, Plagiotheciaceae) in Australia

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## Abstract

A revision of the genus *Isopterygium* in Australia has resulted in recognition of only one species, *I. albescens* in Australia. Of the other species listed for the genus in this country, *Isopterygium minutirameum*, *I. novae-valesiae* and a number of other recorded names have been placed into synonymy with *I. albescens*. *Isopterygium arachnoideum* and *I. subarachnoideum* have been transferred to *Isopterygiopsis pulchella*. The presence of *Isopterygiopsis pulchella* (Schimp.) Z.Iwats. in Australia (considered doubtful by Streimann & Klazenga 2002) is confirmed and the types for Australian species of *Isopterygium arachnoideum*, and *I. subarachnoideum* are placed into synonymy with it. *Isopterygium albescens* is considered to be a member of the family Hypnaceae while *Isopterygiopsis pulchella* is in the Plagiotheciaceae.

*Pseudotaxiphyllum pohliicarpum* (Hypnaceae) is recorded as a new species for Australia.

## Introduction

Prior to Iwatsuki's studies (1970, 1987), the genus *Isopterygium* contained more species, was very heterogeneous and had been placed variously in the Hypnaceae or Plagiotheciaceae. Iwatsuki transferred various species into a number of new genera, e.g., *Pseudotaxiphyllum*, *Isopterygiopsis*, *Herzogiella*, and *Taxiphyllum*, most of which are now included in the family Hypnaceae. The diagnostic characters for these new genera are based on morphological criteria such as absence of pseudoparaphyllia, the location and surface of rhizoids, size and wall of epidermal and cortical stem cells, type of propagules and presence or absence of an annulus (see Iwatsuki 1970: table 3, p. 339; Iwatsuki 1987: fig 1, p. 446 & table 1, p. 450).

*Isopterygium* was included in the new family Pylasiadelphaceae created by a division of Sematophyllaceae s. l. by Goffinet and Buck (2004) in their recent interpretation of moss classification. As *Isopterygium* does not have a number of the characters that define the Pylasiadelphaceae, e.g., the alar cells enlarged and coloured and rostrate operculum, we do not agree with this placement and have returned *Isopterygium* to the family Hypnaceae.

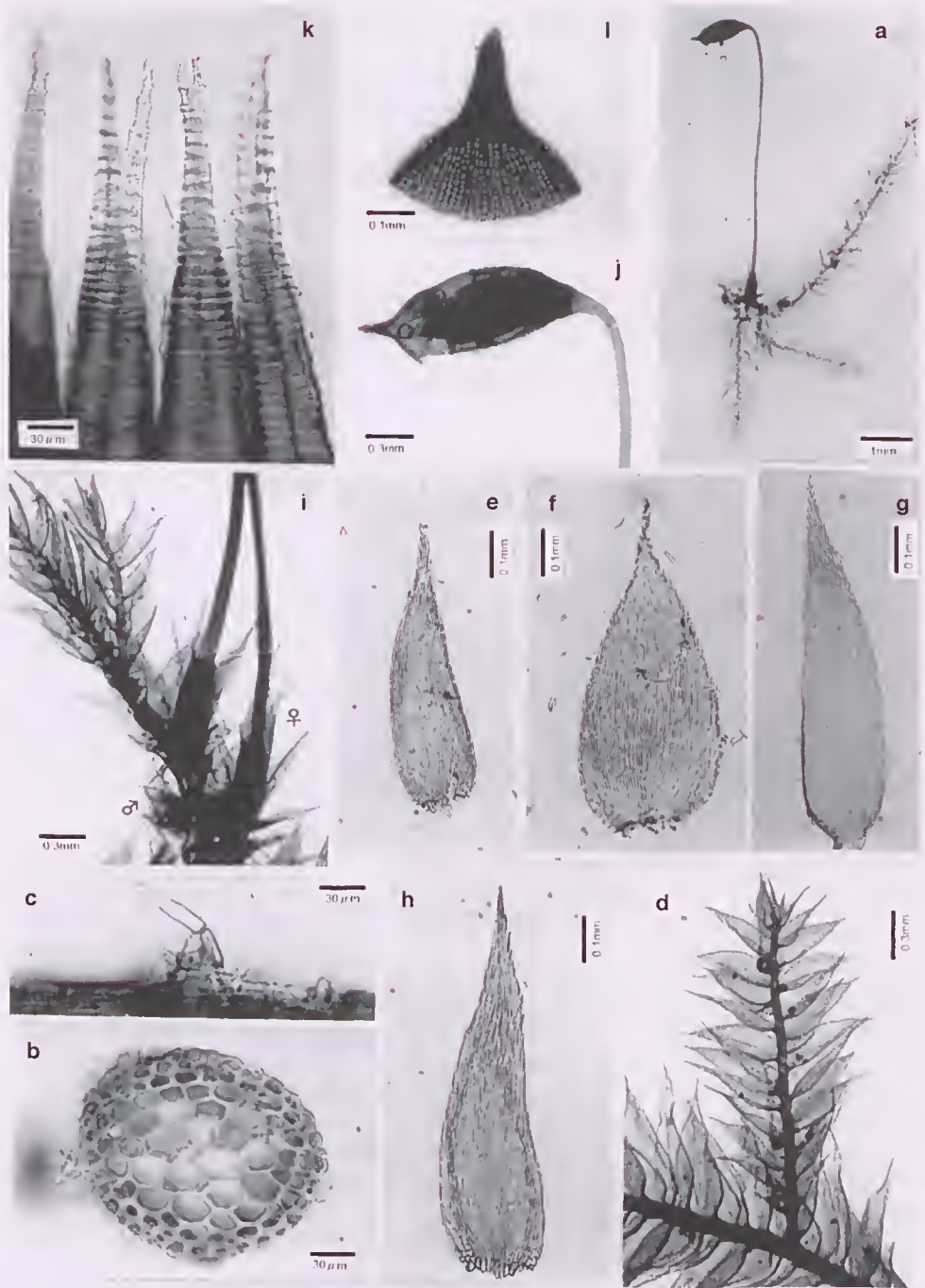


Fig. 1. *Isopterygium albescens*. a, plant with a sporophyte; b, cross-section of branch; c, filamentous pseudoparaphyllia; d, branch with leaves; e–h, variation of leaves; i, sporophytes; j, capsule with operculum; k, peristome teeth; l, operculum. (all figs based on Australian collections; a, j, k & l Schafer-Verwimp 3862, CANB; b–d, f Brock 557, CANB; g lectotype of *I. novaevalesiae*, Watts 1902, NSW; e, h, j Streimann 45351, CANB; photographs by Z. Iwatsuki).

The genus *Isopterygium* contains more than 200 taxa of which 11 names are recorded for Australia, including five endemics (Streimann & Klazenga 2002). Present studies have reduced the total species number in Australia for *Isopterygium* to one, and two of the previously listed endemic species known from types or only a few collections, have been determined as *Isopterygiopsis pulchella*.

The other recorded species, *Isopterygium limatum*, found in New Zealand (Fife 1985) and Australia (Streimann & Klazenga 2002), has been under investigation since it lacks the rostrate operculum, has a well-differentiated annulus, different pseudoparaphyllia, as well as characters such as axillary papillose rhizoids that are not present in *Isopterygium*. Based on studies of Australian, New Zealand and subantarctic (including Macquarie Island, Seppelt 2004) material, this taxon has been placed in a new genus *Anstrohondaella* (Iwatsuki et al. 2009), which has been placed in the Hypnaceae. *Isopterygium acuminatum* and *I. amblyocarpum* are considered synonymous with it.

### *Isopterygium*

*Isopterygium* Mitt., *J. Linn. Soc. Bot.* 12: 21 (1869).

Lectotype: *Hypnum tenerum* Sw. = *Isopterygium tenerum* (Sw.) Mitt. selected by Z. Iwatsuki & M. Crosby, *J. Hattori Bot. Lab.* 45: 389–393 (1979).

**Etymology:** from the Greek *isos* (equal), *pteryx* (wing like) and *ion* (diminutive suffix) in reference to the delicate wing like leaf arrangement.

Defining characters for the identification of *Isopterygium* (Iwatsuki 1987) include leaves ovate to ovate-lanceolate; leaf apices more or less serrulate; costa short and double or absent; rhizoids smooth, rarely scabrous, originating below and between leaf insertions not in leaf axils; epidermis of normal small cells, outer cortical stem cells small and thick-walled forming a sclerodermis, central strand lacking; propagules when present, filamentous or short; sporophytes almost uniform being hypnaceous (diplolepidous) but with absence of annulus, with non-collenchymatous exothecial cells and a short rostrate operculum. Several filamentous pseudoparaphyllia are usually seen around a branch primordium in *Isopterygium*. When a branch primordium grows into a branch a few more or less triangular leaves develop first, occurring at the base of young branches, and primordia are also present on the main stems surrounding the triangular leaves.

Chromosome numbers, summarised here and obtained from Fritsch (1991) and Goldblatt and Johnson (1994, 1998, 2003) are available for several species of *Isopterygium* (North America,  $n = 11, 22, 12 (11+ m)$ ; Europe,  $n=12 (11+m)$ ; Japan,  $n=11, 12$ ; India,  $n=11 (10+m), 12, 22$ , but none is available for Australian populations.

*Isopterygium albescens* (Hook.) A. Jaeger, *Ber. Thatigk. St. Gallischen Narwiss. Ges.* 1876–77: 433 (1878). *Hypnum albescens* Hook. in Schwägr., *Sp. Musc. Suppl.* 3(1): 226b, Tab. CCXXVI. b (1828).

Type: In regno Nepal Indiae lectum dedit Pr. Hooker.

*Isopterygium latifolium* Broth., *Oefv. Finsk. Vetensk. Soc.* 42:114 (1900), *syn. nov.*  
Type: Australia, New South Wales: Alstonville Road, Ballina, W.W. Watts 211, holotype: NSW; isotype: H-BR, MEL 59608).

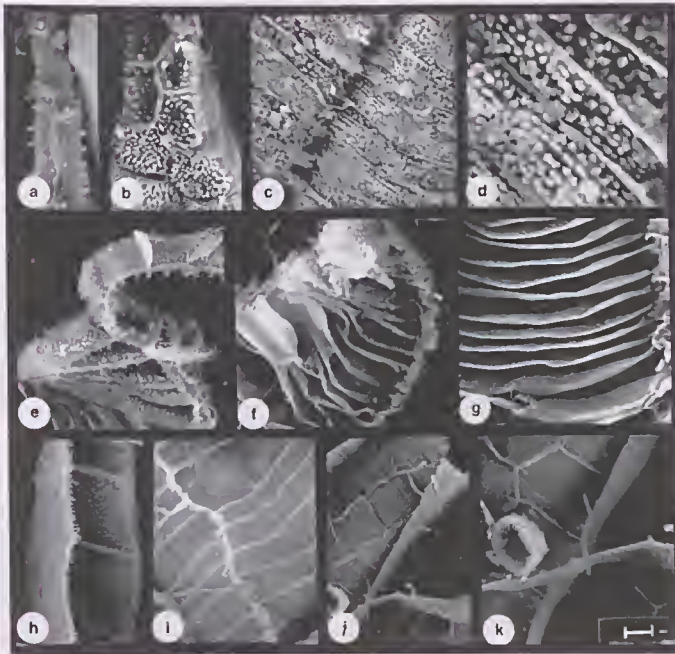


- Isopterygium howeanum* Broth. & Watts, *Proc. Linn. Soc. New South Wales* 40: 380–381 (1915), *syn. nov.* Type: Hillside, back of Johnsons, Lord Howe Island. *W.W. Watts* 112, 8.vii.1911 holotype: (NSW); isotype: (H-BR).
- Hypnum candidum* Müll.Hal., *Linnaea* 35: 624 (1868), *syn. nov.* Type: Australia, New South Wales, Ash Island, Hunter River, *Mrs E. Ford* (MEL 59547). *Isopterygium candidum* (Müll.Hal.) A.Jaeger, *Ber. Thätigk. St. Gallischen Naturwiss. Ges.* 1876–77: 437 (1878) (Gen. Sp. Musc. 2:4503), fide J. H. Willis, *Victorian Naturalist* 71: 161 (1955).
- Hypnum molliculum* Sull., *Proc. American Academy of Arts and Sciences* 3:78 (1854). Type: Hawaii, Mauna Kea, *Wilkes* (BM). *Isopterygium molliculum* (Sull.) Mitt. in Seem., *Fl. Vit.* 399 (1873), fide Dixon *Proc. Linn. Soc. New South Wales* 55: 295 (1930).
- Isopterygium sublatifolium* Broth., *Proc. Linn. Soc. New South Wales* 43: 564 (1918), *nom. nud. in synonym.*
- Hypnum minutirameum* Müll.Hal., *Syn. Musc. Frond.* 2: 689 (1851); *Bryol. Jav.* II, p. 191, Tab. 290 (1808), *syn. nov.* Type: Java: Blume, in *Herb. Al. Braun*, *syn. nov. Isopterygium minutirameum* (Müll.Hal.) A.Jaeger, *Ber. Thätigk. St. Gallischen Naturwiss. Ges.* 1876–77: 434 (1878). *Taxiphyllum minutirameum* (Müll.Hal.) H.A.Mill. & D.R.Smith, *Micronesica* 4: 225 (1968).
- Hypnum norfolkianum* Müll.Hal., *Linnaea* 37: 160 (1872). Type: Norfolk Insula. Ferd. Müller mixed with *Rhacopilum convolutaceum*. holo: BM (Hampe); isotype: NY. *Isopterygium norfolkianum* (Müll.Hal.) A.Jaeger, *Ber. Thätigk. St. Gallischen Naturwiss. Ges.* 1876–77: 435 (1878), fide Streimann (2002), p.100–101.
- Isopterygium baileyannum* Müll. Hal. ex F.M. Bailey, *Syn. Queensland Fl. Suppl.* 2: 71 (1888). *nom. nud. in synonym.* Based on: Qld: Kedron Brook and Port Curtis *F.M. Bailey* (BRI).
- Isopterygium amoenum* Broth., *Oefvers. Finska Vetensk. Soc. Foerh* 42: 112 (1900), *syn. nov.* Type: Australia, New South Wales: Richmond River, *W.W. Watts*, n. 802, 888, lectotype: HBR (*Watts* 888), isolectotype: NSW (*Watts* 888) [selected here]; *syn:* H-BR (*Watts* 802), isosyntypes: MEL, NSW (*Watts* 802).
- Isopterygium neocaledonicum* Thér., *Bull. Acad. Int. Géogr. Bot.* 19: 23 (1909), *syn. nov.* Type: New Caledonia, Rivière Carricouyé, *Franc* (BM).
- Isopterygium viridepallens* Müll.Hal. ex Burges, *Proc. Linn. Soc. New South Wales*, 60: 93 (1935). *nom. nud. in synonym.* Based on: N.S.W. Gosford *W. Forsyth* 442, 19.ix.1891; Lane Cove *W. Forsyth* 497, National Park *W. Forsyth* 492 (NSW).
- Isopterygium minutirameum* f. *brevifolium* M.Fleisch. *Die Musci der Flora von Buitenzorg* 4: 1427. 1923. *Taxiphyllum minutirameum* (Müll.Hal.) H.A.Mill. & D.R.Smith var. *brevifolium* (M.Fleisch.) H. Whittier, *Florida Scientist* 38: 103 (1975).
- Hypnum austropsillum* Müll.Hal., *Linnaea* 37: 159 (1872). Type: Qld: Brisbane River, *Dietrich*. (BRI). *Isopterygium austropsillum* (Müll.Hal.) A.Jaeger, *Ber. Thätigk. St. Gallischen Naturwiss. Ges.* 1876–77: 435 (1878). (Gen. Sp. Musc. 2: 501).
- Isopterygium anstrosnulatatum* Müll.Hal. ex Burges, *Proc. Linn. Soc. New South Wales* 60: 93 (1935), *nom. nud. in synonym.* A *Watts* specimen bearing this name is held at NY (*W. Buck*, pers. comm.): *W.W. Watts* 1586, Sep 1897 (*n.v.*).

*Isopterygium novae-alesiae* Broth., *Oefv. Finska Vet. Soc. Foerh.* 42: 113 (1900), *syn. nov.* Type: Australia, New South Wales : Richmond River, Fernleigh, W.W. Watts 1902, lectotype [selected here]: H-BR, isolectotype: NSW. From the original list of types the following become *residual syntypes* -. New South Wales, Richmond River, Fernleigh, W.W. Watts (n. 1384, 1399, 1403, 1900); Pearce's Creek (1395, 1408); Teven (1430 ex. p.) Alstonville (470); Uralba (1801), all held H-BR, NSW, except for Watts 1395 (which at NSW is a poor specimen, not *Isopterygium*).

**Illustrations:** Dozy & Molkenboer, *Bryologia Javanica*, vol II, p. 193, tab. CCXC, (1868), as *Hypnum*; Bartram, *Mosses of the Philippines*, plate 27, fig. 474 (1939). Gangulee, *Mosses of Eastern India and Adjacent Regions* 7: 1960, fig 1007 (1979). Noguchi, *Illustrated Moss Flora of Japan* 5: 1051, fig. 462A (1994).

Plants autoicous, slender, small to medium-sized, in pale yellow-green, grey-green to green, slightly glossy prostrate mats. Stems creeping, irregularly pinnately branched, to 6.0 cm long. In cross-section, stem without central stand, and the cortex with 2 outer layers of firm-walled cells. Pseudoparaphyllia filamentous. Branches short, ascending, often loosely foliated. Rhizoids smooth, red, sparsely developed on underside of stem between leaves. Branches suberect, simple or with branchlets 1.0–1.5 cm. Leaves ovate,



**Fig. 2.** Scanning electron micrographs of the peristome of *Isopterygium albescens* (as *I. novaealesiae*). a, close view of apex of exostome tooth; b, tooth below apex showing papillose surface; c & d, pattern of lamellae and papillae between, on abaxial surface in lower part of tooth; e, side view of exostome tooth near apex curled over showing lamellae; f, closer view of lamellae in base of mid tooth; g, lamellae towards base of tooth, smooth no papillae; h, abaxial view of endostome segment near apex; i, abaxial view of basal membrane with smooth surface; j, cilia curved back over basal membrane; k, spore, cilium and basal membrane behind. [*H.P. Ramsay 181115* (NSW).] Scale bar a, b, e, g, h, k = 20  $\mu$ m; c, f, i = 10  $\mu$ m; j = 100  $\mu$ m. [SEM's prepared by Meera Jayachandran at University of New South Wales.]

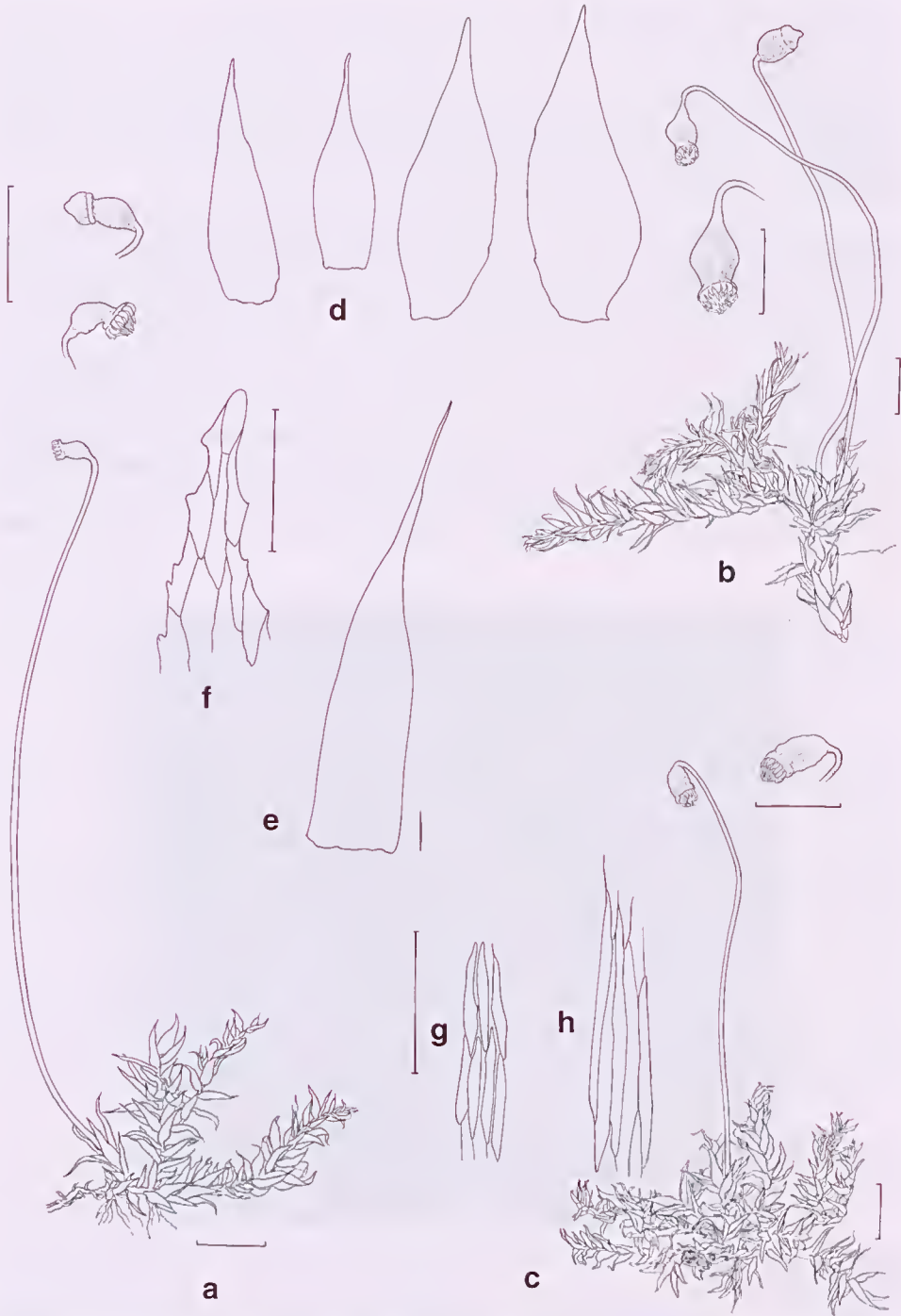
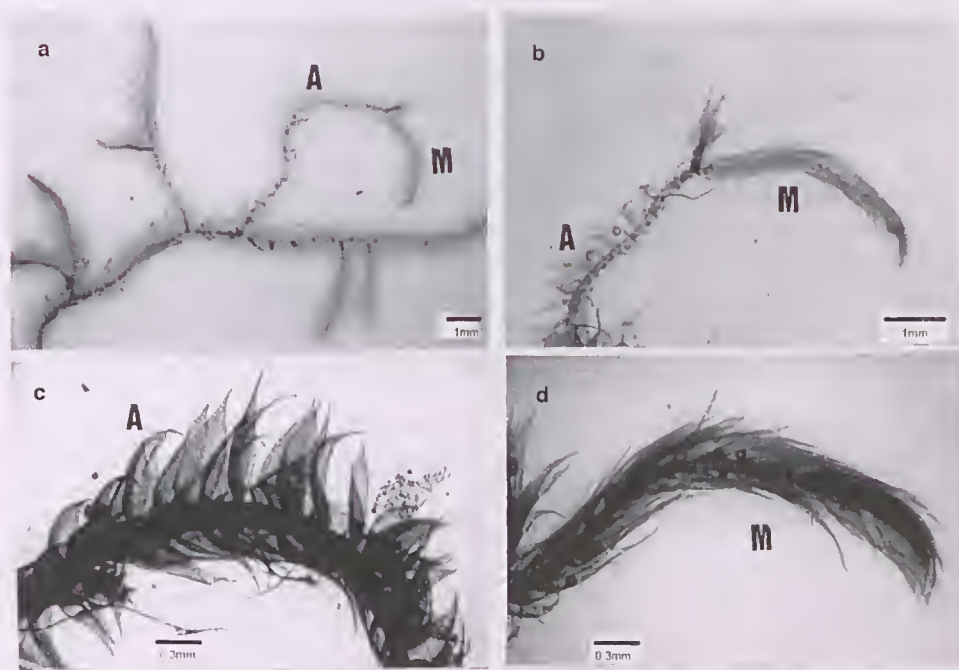


Fig. 3. Illustrations showing variation in *Isopterygium albescens* in Australia. **a**, habit with capsules (as *Isopterygium novaevalesiae*, isolectotype, Watts 1902, NSW); **b**, habit with capsules (as *Isopterygium minutirameum*, Watts 4584, NSW); **c**, habit with capsules (as *Isopterygium albescens*, Watts 235, NSW); **d1–4**, variation in leaves: **d1** stem leaf, **d2–d4** branch leaves; **e**, perichaetial leaf; **f**, apical leaf cells; **g**, upper leaf cells; **h**, midleaf cells. (Drawings by: D. Mackay (habit of *I. novaevalesiae*), C. Wardrop & H.P. Ramsay). Scale bars: 1.0 mm for habits and leaves; 100  $\mu$ m for cellular drawings.



ovate-lanceolate or lanceolate, usually slightly concave, erect-patent,  $0.6\text{--}1.2 \times 0.28\text{--}0.35$  mm, asymmetrical, margins entire or obscurely serrate or denticulate above, apex gradually acuminate to a slenderly tapering narrow acumen, slightly falcate towards ends of branches. Laminal cells in midleaf narrow,  $70\text{--}100 \times 4\text{--}8$   $\mu\text{m}$ , linear to vermicular; apical cells short rhomboid (4:1); cells in alar region consisting of 2–3 small thick walled, shortly rectangular or irregularly shaped hyaline cells, basal row of subrectangular cells. Perigonia on branches and lower parts of stems, rounded budlike. Perichaetia on stems, inner perichaetial leaves gradually long acuminate. Calyptra smooth, cucullate 1.0 mm long. Seta long-exserted, 0.6–1.2 cm, pale red; capsules frequently produced, oblong-ovoid, curved, horizontal or pendulous, operculum bluntly curved-rostrate; peristome double, exostome teeth 16, endostome 16, same length as exostome, with single cilium as long as segments. Spores 9–13  $\mu\text{m}$ , finely papillose. Figs. 1–4

Distributed in Himalayas, Malesia, and tropical and subtropical Asia as far north as Japan, on Pacific Islands, in New Zealand and Australia. Specimens collected by W.W. Watts on Lord Howe Island as *Isopterygium howeanum* or *I. candidum* are *I. albescens*. With the transfer to *Isopterygiopsis* of *Isopterygium pulchellum* and the exclusion of *I. limatum* from the genus (Iwatsuki et al. 2009), distribution of *Isopterygium* in Australia is confined to the mainland chiefly in coastal regions from tropical northern Western Australia, Northern Territory and Queensland south to New South Wales and Victoria.



**Fig. 4.** *Isopterygium albescens*, showing variation of leaves. **a, b**, part of plant showing two types of leaves (A shows ovate to ovate-lanceolate leaves, M shows lanceolate leaves); **c**, part of branch with ovate to ovate-lanceolate leaves (plants with this type of leaves have been called *Isopterygium albescens*); **d**, branch with lanceolate leaves (plants with this type leaves have been called *Isopterygium minutirameum*). (all from *Russell-Smith 6200*, CANB; photographs by Z. Iwatsuki).

Dalton et al. (1991) noted that *I. albescens* had been listed for Tasmania although Scott and Stone (1976) recorded it only from the mainland. Streimann and Klazenga (2002) have listed *I. albescens* for Tasmania but no specimens have been located by us. The genus is thus absent from the temperate regions of southern Western Australia, South Australia and Tasmania. Fig. 5

**Selected specimens. Western Australia:** Galvin Gorge, G. Kantak & S.P. Churchill 687 (NY, NSW); **Northern Territory:** Kakadu, L.A. Craven & G. Whitbread 6801 (CANB); Wangi Road, Walker Creek 68 km SSW of Darwin, H. Streimann 8814 (CANB); Katherine Gorge, G.E. Kantak 696 (CANB). **Queensland:** Babinda, W.W. Watts Q300 (NSW); Malanda, W.W. Watts 577 (NSW); Cairns, W.W. Watts 235 (NSW). **New South Wales:** Manning River, E. Cheel 485 (NSW); Pimlico, Richmond River, W.W. Watts 432 (NSW); Alstonville Road, Alstonville, W.W. Watts 612 (NSW); Wardell Road, Richmond River, W.W. Watts 687 (NSW); Stanwell Park, W.W. Watts 8267 (NSW); Lord Howe Island, north end of island in closed rainforest, D.H. Vitt 28327 (NSW). **Victoria:** Dandenongs, East Gippsland, E. Ronfield s.n. (MEL).

We had much difficulty in identifying and separating specimens of *I. albescens* and *I. minutiramenn*, because these two species are extremely variable in shape and colour of leaves. *Isopterygium albescens* and *I. minutiramenn* are usually distinguished as follows:

1. Plants often whitish, leaves ovate to ovate-oblong ..... *I. albescens*
1. Plants not whitish, leaves lanceolate, slenderly tapering to a narrow acumens ..... *I. minutiramenn*

However, the above key does not work well for many specimens of *Isopterygium* in Asia or Australia. Recently, we found a very interesting specimen which has two types of leaves on one plant. The specimen had been determined as *I. minutiramenn* (Northern Territory, Butterfly Springs, J. Russell-Smith 6200, CANB). As shown in Fig. 4 some branches (marked by M) have leaves defined in the key as *I. minutiramenn*, and some other branches (marked by A) have leaves defined in the key as *I. albescens*. Identifications of specimens of *I. albescens* and *I. minutiramenn* have often been changed from *I. albescens* to *I. minutiramenn* or vice versa. For these reasons, we reduce *I. minutiramenn* to a synonym of *I. albescens*. In North America, *Isopterygium tenerum*, which is related to our *I. albescens*, is also extremely variable and includes two types of leaves comparable to those of *I. albescens* and *I. minutiramenn*. These variants



Fig. 5. a, Distribution of *Isopterygium albescens* in Australia; b, Distribution of *Isopterygiopsis pulchellum* in Australia.



have been given varietal status, e.g. var. *fulvum*, var. *minims*, var. *grontii*, etc. but Crum and Anderson (1981) note that the species is extremely variable, and that it is useless to segregate such varieties.

There has been confusion in the identity of the species *Isopterygium novae-valesiae* Broth., considered an Australian endemic until these studies, as it has been known as either *Isopterygium* (Broth. 1900) or *Taxithelium* (Broth. 1908). While revising the Australian species of *Taxithelium*, the type collections from H-BR and isotypes from NSW of *Isopterygium* [*Taxithelium*] *novae-valesiae* were examined by Ramsay et al. (2002a) and again recently by Paulo Câmara at the Missouri Botanical Garden, who has been carrying out a world revision of the genus *Taxithelium*. Both confirm that the type specimens listed by W.W. Watts and held at H-BR and NSW do not contain any *Taxithelium* species. *Isopterygium novae-valesiae* has non-papillose cells while *Taxithelium* has pluripapillose cells. Brotherus, however, did allow for non-papillose species in his concept of *Taxithelium*, a view not currently accepted.

The lectotype specimen (Watts 1902) of *Isopterygium novae-valesiae* has non-papillose cells, and after careful examination, we have reduced it to synonymy with *I. albescens*. Specimens of this vary somewhat from other collections of *I. albescens* as recognised here. They are often pale yellow-green and have much longer setae and slightly larger more acuminate leaves than the general collection.

Many specimens from north-eastern New South Wales were examined and identified by Brotherus as *Isopterygium candidum* (Müll.Hal.) A.Jaeger in the 1890's. Most of the specimens from New South Wales with this name have been re-determined as *I. minutirameum* (now *I. albescens*). However, those from Lord Howe Island are correctly named as *I. albescens*.

### *Isopterygiopsis*

*Isopterygiopsis* (Hedw.) Iwatsuki, J. Hattori Bot. Lab. 33: 379–380 (1970)

Type: *Plagiothecium muellerianum* Schimp.

**Etymology:** derived from the name *Isopterygium* (see above) and the Greek *-opsis* (appearance) in reference to the similarity between the two genera.

Plants dioicous or autoicous, medium sized to small, shiny; stems creeping, irregularly pinnately branched; in cross section of stem, epidermal cells large, thin-walled and often hyaline, or small and more or less thick-walled; central strand indistinct, rhizoids papillose and axillary; pseudoparaphyllia absent; when present, gemmae occur as axillary fascicles of filamentous propagulae 3–7 cells long; annulus differentiated. Leaves erect to wide-spreading and weakly to distinctly complanate; narrowly lanceolate triangular, acuminate, entire. Setae long, capsules suberect, annulus 2 rows of cells, operculum bluntly low-conic. Peristome hypnoid.

*Isopterygiopsis* was described by Iwatsuki (1970) for species similar in appearance to *Isopterygium* in size, but different in having no pseudoparaphyllia on stems, large hyaline or thin-walled epidermal cells in stem cross-sections and axillary papillose rhizoids instead of smooth rhizoids arising below leaf insertion, filamentous propagules and having a differentiated annulus. It is more similar to *Plagiothecium* in characters of pseudoparaphyllia and propagulae, but differs in having non-decurrent leaf-bases

(Iwatsuki 1987). As part of a revision of the genus *Isopterygium* for the Flora of Australia by us, the specimens for *Isopterygium pulchellum* (Hedw.) A.Jaeger = *Isopterygiopsis pulchella* (Hedw.) Iwats. were examined as its occurrence in Australia has been reported as doubtful' (Streimann & Klazenga 2002). Recent studies of specimens and types of *Isopterygium arachnoideum* and *I. subarachnoideum*, now placed into synonymy with *Isopterygiopsis pulchella* (see below), confirm its presence in Australia.

***Isopterygiopsis pulchella*** (Hedw.) Z.Iwats., *J. Hattori Bot. Lab.* 63: 450 (1987). *Leskea pulchella* Hedw., *Sp. Musc.* 220 (1801). *Isopterygium pulchellum* (Hedw.) A.Jaeger & Sauerb., *Ber. St. Gall. Naturw. Ges.* 1876–77: 441 (1878).

**Type:** In silvis umbrosis Scotiae (Hedwig 1801).

*Isopterygium arachnoideum* Broth., *Oefvers Finska Vetensk.-Soc. Foerh.* 42: 112 (1900). Type: Australia, New South Wales, Richmond River, Teukombil (=Tuckumbil) Hunter's Scrub, on tree fern trunks. *W.W. Watts 549*, lectotype H-BR, isolectotype (4 specimens in NSW)[selected here]. syntype: Three mile scrub, tree fern trunks *W.W. Watts 879* (NSW, H-BR). [Note *W.W. Watts 587* in MEL is not a type, refer to Ramsay and Seur (1994)]

*Isopterygium subarachnoideum* Broth. *Oefvers Finska Vetensk.-Soc. Foerh.* 42: 113 (1900). Type: Australia, New South Wales, Richmond River, Hunter's Scrub, on tree fern trunk, *W.W. Watts 744*, lectotype: H-BR; isolectotype: NSW [selected here]. No specimen of the syntype *Watts 588* was found in H-BR or NSW.

**Illustrations:** Crum and Anderson, *Mosses of eastern North America*, vol. 2, fig 582 (1981); Ignatov & Ignatov, *Moss flora of the middle European Russia*, vol. 2: fig 439 (2004); Ireland, *Moss flora of the Maritime Provinces*: fig. 357 (1982); Nyholm, *Illustrated moss flora of Fennoscandia*. II. Musci, fasc. 5: fig. 411 (1965) - all as *Isopterygium pulchellum*. Smith, *The moss flora of Britain and Ireland*, 2nd ed.: fig. 295. 9–11 (2004); Zhang & Si, *Hypnaceae. Moss flora of China*, English Version: pl. 689 (2005) - both as *Isopterygiopsis pulchellum*.

Plants autoicous, small and slender in shiny, bright-green or yellow to greyish-green flat mats. Stems creeping, mostly unbranched with several arising at base of perichaetia, stem in cross section with epidermal cells not so large, with outer wall thin or slightly thickened and with an indistinct central strand. Branches numerous, often ascending; pseudoparaphyllia absent. Leaves usually not crowded, erect to wide-spreading and weakly to distinctly complanate, often secund at tips, 0.7–1.2 mm long, narrowly lanceolate-triangular, slenderly acuminate, not decurrent, less than 0.2 mm wide at base, entire, ecostate. Laminal cells linear in midleaf 35–70  $\mu\text{m}$  x 5  $\mu\text{m}$ , 7–14:1 long as wide, cells scarcely differentiated at basal angles. Propagules occasionally present, axillary fusiform or cylindrical, 2–5 cells long. Perigonia numerous and usually present on lower stems. Perichaetia on stems. Perichaetial leaves erect, similar in size to leaves. Setae 8–16 mm long, orange or yellow, becoming orange-red; capsules suberect and nearly symmetric to inclined and asymmetric, oblong-cylindric, capsules mostly 1.0–1.5 mm., annulus of 2 rows of cells; operculum low-conical with a short rostrum; peristome hypnoid, endostome with non-perforate segments and single (sometimes paired) cilia. Spores 9–13  $\mu\text{m}$ , minutely roughened. Chromosome numbers  $n=10+m$ ,  $10+2m$ , 22 (none Australian, Fritsch 1991). Fig. 6

Distributed, in North America, Europe, Asia, Africa, New Zealand and Australia (Queensland, New South Wales, Victoria, Tasmania). In N.S.W. most specimens occur

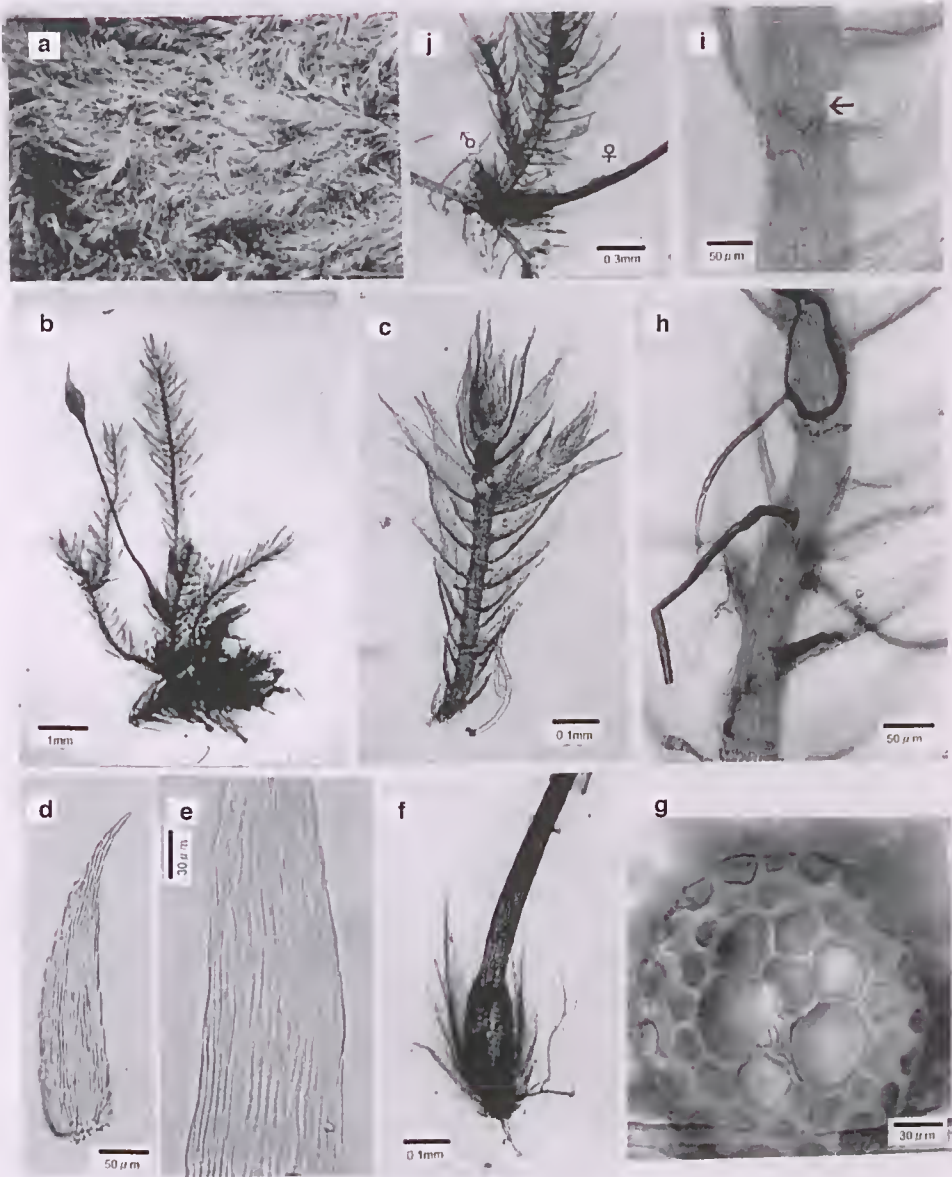


Fig. 6. *Isopterygiopsis pulchella*. a, plants; b, plant with sporophyte; c, branch; d, e, leaves; f, perichaetium; g, cross-section of stem; h, branch with rhizoids; i, branch with branch primordia (arrow); j, plant with male and female inflorescences. (all based on Australian material; a, c–e, & g–j I.R. Telford, CANB; b & f W.W. Watts 577, NSW; photographs by Z. Iwatsuki).



on the trunks of tree ferns from sea level to subalpine in the Blue Mts. and on the coast and coastal ranges as far north as the Richmond River district and the Border Ranges between N.S.W. and Qld possibly as far north as Eungella National Park. In Tasmania it occurs mainly on wood or tree trunks in the west and south-west at altitudes below 300 m. Fig. 5

**Selected Specimens:** **Australia:** **Queensland:** McPherson Range, Coomera Range, *I.R. Telford s.n.* (CANB). **New South Wales:** Valley of Waters, Blue Mts, *W.W. Watts 5434, 5435, 5436, 10471* (NSW); Woodford, Blue Mts, *W.W. Watts 8275* (NSW); Brunswick River, *W.W. Watts 1586, 1591* (NSW), *4195* (MEL); Tuckombil, *W.W. Watts 577 (as I. arachnoideum) 4912, 4913, 4908* (NSW), *W.W. Watts 587 (as I. arachnoideum)* (MEL); Ballina *W.W. Watts 2874, 5849* (NSW); Stanwell Park *W.W. Watts 8277* (NSW); Cambewarra *W.W. Watts 6590, 9930, 9946* (NSW); Bulgong Heights *W.W. Watts s.n.*, May 1916 (NSW 245517); Belmore Falls *W.W. Watts 9822* (NSW); Nowra *W.W. Watts 8268* (NSW); Tomerong *W.W. Watts 6235, 6236* (NSW); "Kingwell", Wyong *W.W. Watts 9604, 9480, 8971, 8972, 9631, 9715, 9532, 9722* (NSW); Gladesville, Sydney *W.W. Watts 9289* (NSW); Manly, Sydney *W.W. Watts 6815, 6820* (NSW), Neutral Bay, Sydney *W.W. Watts 8000* (NSW); Brindle Creek, Wiangarie S.F. *H. Streimann s.n.* (CANB); Dorriggo N.P. *H. Streimann s.n.* (CANB); **Victoria:** Mt Drummer, N.A.S. *Wakefield s.n.* (MEL 1031453); **Tasmania:** West Coast W.A. *Weymouth 2793* (HO); Zeehan Railway, W.A. *Weymouth 630* (HO); Recherche, W.A. *Weymouth 2586, 2587, 2618, 2619* (HO).

The following key is provided to assist in identifying the now recognised Australian taxa that were formerly *Isopterygium*, i.e. *Isopterygium*, *Isopterygiopsis* and *Austrohondaella*.

1. Leaves acuminate with more or less serrulate apices; rhizoids smooth, arising between leaves on stem; pseudoparaphyllia filamentous; capsule curved, horizontal or pendulous; annulus absent, operculum bluntly apiculate or curved rostrate ..... *Isopterygium albescens*
1. Leaves with entire apices; rhizoids papillose, arising from leaf axils; pseudoparaphyllia absent or foliose; capsule erect or suberect to inclined; annulus present; operculum low conic or blunt
  2. In section, stems with large thin-walled epidermal cells, thick-walled outer cortex, thin-walled inner cells, central strand present; capsule suberect to inclined, operculum low conic; pseudoparaphyllia absent ..... *Isopterygiopsis pulchella*
  2. In section, stem with small epidermal cells, an outer sclerodermis and inner thin walled cortical cells, central strand absent; capsule erect, symmetrical; operculum bluntly conic; pseudoparaphyllia foliose ..... *Austrohondaella limata*

### New records for Australia

Among the Australian collections examined during this study, the following specimens of *Pseudotaxiphyllum polhiicarpum* (Hypnaceae) were discovered and are clearly identified by the *Polhia*-like gemmae (Iwatsuki 1987, Noguchi 1994). The earliest collection is that of Watts in 1916, and a more recent collection is that of H. Streimann in 1991. These are the first records of this species for Australia.

*Pseudotaxiphyllum polhiicarpum* (Sull. & Lesq.) Z.Iwats., *J. Hattori Bot. Lab.* 63: 449 (1987). *Hypnum polhiacarpum* Sull. & Lesq., *Proc. Am. Ac. Art Sc.* 4: 280 (1859). *Isopterygium polhiicarpum* (Sull. & Lesq.) A.Jaeger, *Ber. Thätigk. St. Gallischen Naturwiss. Ges.* 1876–77: 442 (1878).

**Specimens examined:** **Australia:** **New South Wales:** Northern Tablelands: Weeping Rocks, New England National Park, 72 km of Armidale, *Nothofagus–Elaeocarpaceae* dominated forest, at base of escarpment, on shaded rock face, H. Streimann 47736 (CANB, NY). Central Coast: Sassafras Gully, Springwood W.W. Watts 10917 Jan 1916 (NSW 245625).

**Distribution:** Japan, China, Vietnam, Laos, Thailand, Philippines, new to Australia.

### Names transferred elsewhere or specimens not found

*Isopterygium caespitosum* Paris, *Index Bryol. Suppl.* 218 (1900), *nom. nud.* = *Taxicaulis caespitosus* Müll.Hal., *nom. nud.* Not found.

*Isopterygium nitens* E.B.Bartram. A specimen labelled type ('co-type') with this name at NSW collected in Western Australia was redetermined by Bartram as *Sauloma zetterstedtii* (Müll.Hal.) A.Jaeger. Subsequently in a note J. H. Willis says he preferred to treat it as the 'western form of *Sauloma tenella* (Hook.f. & Wilson) Mitt.'

*Isopterygium pseudosubulatum* (Müll.Hal.) Paris, *Ind. Bryol. Suppl.* 220 (1900) (*Taxicaulis* 1887) is a non Australian taxon (see Streimann & Klazenga, 2002, p. 198). A Whitelegge specimen bearing this name is held at NY (W. Buck, pers. comm.): T.W. Whitelegge, 1886 (*n.v.*).

*Isopterygium teysmannii* Broth. = *Taxiphyllum taxirameum* (Mitt.) M.Fleisch.

*Hypnum teysmannii* Sande Lac., *Bryologia Javanica* 2: 192, 290. 1868. *Isopterygium teysmannii* (Sande Lac.) A. Jaeger, *Ber. Thätigk. St. Gallischen Naturwiss. Ges.* 1876–1877: 433 (1878).

*Isopterygium umbilicatum* Mitt., *Trans. & Proc. Roy. Soc. Victoria* 19:86 (1882), *nom. nud.* = *Ectropothecium* sp.

*Isopterygium viridepallidus* Müll.Hal. ex W.Forsyth, *Proc. Linn. Soc. New South Wales* 24: 683 (1900), *nom. nud.* Not found.

*Isopterygium walterianum* (Hampe) Mitt., *Trans. Roy. Soc. Victoria* 19:86 (1882). *Hypnum walterianum* (Hampe) A.Jaeger, *Ber. Thätigk. St. Gallischen Naturwiss. Ges.* 1877–78: 320 (1880). (*Gen. Sp. Musc.* 2: 584). Type: Victoria: Mt. Macedon, *Walter* = *Hypnum cupressiforme* Hedw. var. *mosmannianum* (Müll.Hal.) Ando.

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